Assessing Multifamily Residential Parking Demand and Transit Service

THIS STUDY EXAMINED THE RELATIONSHIP OF MULTIFAMILY RESIDENTIAL PARKING DEMAND AND TRANSIT LEVEL OF SERVICE IN TWO KING COUNTY, WA, USA, URBAN CENTERS: FIRST HILL/CAPITOL HILL (FHCH) AND REDMOND. IN ADDITION, CURRENT PARKING POLICIES WERE ASSESSED FOR THEIR ABILITY TO MEET THE OBSERVED PARKING DEMAND, AND AN ALTERNATIVE METHOD TO COLLECT PARKING DEMAND DATA WAS EXPLORED.

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INTRODUCTION

Parking policies greatly affect land use patterns in cities and are intertwined with automobile use, traffic congestion, housing affordability, and environmental impacts. Off-street parking requirements in multifamily residential developments have become commonplace in the United States, and planners have observed serious implications with their use. Planners typically have limited parking demand data available on which to base their parking requirements. When parking data are available, they are often either outdated or based on a different development or transportation system context, including varying levels of public transit service.[1] Experience has shown that creating parking policies based on this flawed data can result in an overbuilt parking supply, which encourages automobile use and discourages transit use. As cities look to increase transit ridership to achieve regional planning goals, it is important to consider parking policy in concert with transit service provision. High levels of transit service can provide a viable alternative to owning a vehicle, which lowers the parking demand for new developments. When cities set parking policies based on information that is reflective of locally observed parking demand and is calibrated to the level of transit service provided, they can reduce the cost of development and encourage alternatives to owning and driving an automobile.

Based on local experience from transportation planners and literature reviewed, it is hypothesized that that higher levels of transit service result in lower residential parking demand. This research hypothesis was explored by conducting parking demand counts at multifamily residential apartment buildings, per ITE *Parking Generation* methodology, and calculating transit level of service for two urban centers in King County, Washington, USA. Using the findings from this research, parking policies used in each urban center were analyzed for their ability to meet true parking demand. In addition, a Washington State Department of Licensing (DOL) database for registered vehicles was assessed for its accuracy in determining parking demand. By collecting local, context-sensitive data on parking demand and its relationship to varying levels of transit service, jurisdictions and developers may be better informed to build parking that meets the true demand.

BACKGROUND

Parking is an important component in the complex transportation system that moves people and goods throughout an area. As urban areas continue to grow, planners often look to zoning regulations to help shape future development in a more environmentally and socially sustainable manner. In addition, pubic transportation agencies are striving to provide an inexpensive mobility option that can reduce the environmental impacts of excessive automobile use. It has been found that parking policies not only have an impact on the formation of urban environments, but they also have a strong relationship with transit service planning.

A common regulatory mechanism that jurisdictions use to control residential parking supply are zoning codes that specify minimum parking requirements for off-street parking in new residential developments. These requirements are used to ensure that new residential development contains an adequate number of parking spaces in order to avoid parking spillover onto adjacent streets and properties, to maintain traffic circulation, and to ensure the economic success of the development.[2] The requirements strive to prescribe the exact number of parking spaces. Supplying less parking than demand warrants can inconvenience residents and potentially result in spillover parking on adjacent neighborhood streets. Conversely, supplying more parking than is demanded can increase the cost of property development and reduce affordability of the new residential housing, while at the same time creating unnecessary environmental impacts such as encouraging additional car ownership and use and making transit usage less convenient and efficient.

Off-street parking requirements have become commonplace, and some planners have observed serious implications with their use, including impacts to travel, housing affordability, the environment, and transit service. As previously discussed, the parking supply built to meet the parking requirements is often in excess of parking demand. This surplus of parking has implications on transportation mode choice, providing incentives for residents to own more vehicles, drive them more, and use transit or other modes of transportation less.[3] As long as perceived free parking is available, people will continue to use their vehicles. This trend is counterproductive to many of the sustainable development policies planners aspire to implement today. As our cities become more populated and denser, transit has been identified as a way to provide an affordable means of travel and to create healthy, compact communities. The off-street parking requirements that have become commonplace today present a barrier to implementing these modern-day planning goals.

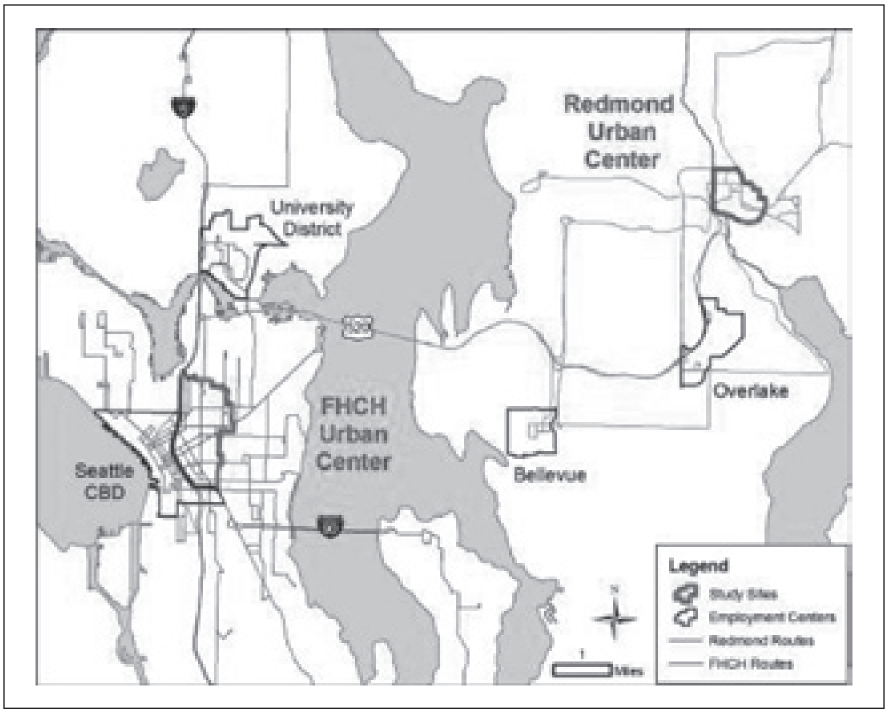

Figure 1. FHCH and Redmond urban center context map.

METHODS

We used a combination of parking utilization counts and geographic information systems (GIS) analysis at the First Hill/Capitol Hill (FHCH) and Redmond urban centers to compare and contrast parking demand of multifamily apartment buildings and transit level of service (LOS) characteristics.

Site Selection

We chose the FHCH and Redmond because they represent two distinct types of development and different levels of transit service. FHCH is an urban area close to downtown Seattle (see Figure 1), which has high population density and robust transit service. Redmond is a growing suburban area about 15 miles east of Seattle, with lower population density and less transit service, focused mainly on peak-hour commuter service. To assess parking demand, eight apartment buildings were selected to conduct parking utilization counts, four in each urban center.

Parking Demand

To assess parking demand in each apartment building, one parking utilization count was conducted for each study site. Methodology for conducting the counts was modeled after the ITE parking demand observations used to support the *Parking Generation* report. Parking demand is defined as the "accumulation of vehicles parking at a given site at any associated point in time…This value should be the highest observed number of vehicles within the hour of observation."[4] Parking counts were completed during midweek days (Tuesday through Thursday) in March and April of 2010 at the peak parking demand hours for residential land uses between 12:00 a.m. to 5:00 a.m. The parking utilization count consisted of counting the number of parked cars in the residential portion of the parking garage or lot at the time of the count. The cars parked in visitor or retail-designated parking spaces were not included.

Using the data collected from these parking utilization counts, a peak period parking demand calculation was completed for each site and then averaged for each urban center. The methodology for calculating peak period parking demand also follows ITE methodology and is defined as number of vehicles parked divided by the number of occupied dwelling units. Finally, a weighted average parking demand ratio for each urban center was calculated by dividing the sum of all vehicles parked in one urban center by the sum of all occupied dwelling units in that same urban center.

We explored the accuracy of an alternative method to collect parking demand information. Parking demand calculations were compared to database queries from the DOL database for registered vehicles in King County. To count the number of registered vehicles at each site, the database was queried by the address of each apartment complex, and the total number of registered vehicles at each site was counted. To assess the accuracy of this method, a regression analysis was conducted for the DOL vehicle counts against the observed vehicles counted at a 95 percent confidence level.

Transit Level of Service Analysis

We developed indicators to measure the different levels of transit service,

Table 1. Transit level of service indicator summary.	
Indicator	**Metric**
Geographic Frequency	Percentage of population living within a quarter-mile of frequent transit service (15-minute headways), averaged using four employment center destinations.
Geographic Span	Percentage of population within a quarter-mile of all-day transit service (16 or more hours).
Weighted Travel Time	Extra time spent in transit compared to automobile. Travel time includes total door-to-door time to major employment centers weighted by employment.
Reliability	Average on-time transit performance.

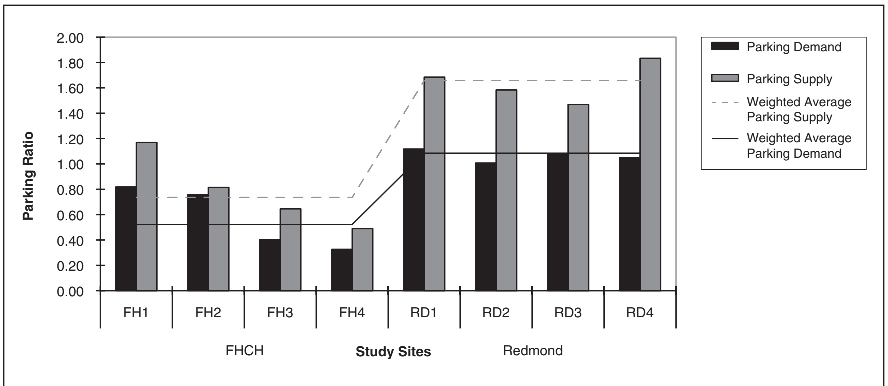

Figure 2. Parking demand compared to parking supply.

Table 2. Parking supply and demand compared to parking regulations.

	First Hill/Capitol Hill				Redmond			
	FH1	**FH2**	**FH3**	**FH4**	**RD1**	**RD2**	**RD3**	**RD4**
Year Built	**2003**	**2008**	**2006**	**2005**	**1990**	**1999**	**1999**	**2004**
Parking Regulation (minimum spaces per dwelling unit, unless noted otherwise)	1.15	N/A*	0.5	0.33–-1 **	1+ - 2.25 ***			
Parking Demand (Vehicles per dwelling unit)	0.82	0.76	0.40	0.33	1.12	1.01	1.08	1.05
Parking Supply (spaces per dwelling unit)	1.17	0.81	0.65	0.49	1.68	1.58	1.47	1.83
Weighted Average Parking Supply	0.74				1.66			
Weighted Average Parking Demand	0.52				1.08			

* No parking requirement.
** 0.33 spaces for each dwelling unit with 2 or fewer bedrooms and 1 space for each dwelling unit with 3 or more bedrooms.
*** 1 space per dwelling unit minimum and 2.25 spaces per dwelling unit maximum. 1+ indicates that an additional one guest space per four units is also required.

summarized in Table 1. There are numerous indicators, as noted in Transportation Research Board's *Quality of Service Manual*, but many of them require data not readily available, and some are not relevant because of the commonality of transit providers in each study site.[5] We measure geographic frequency and geographic span as indicators of walking accessibility to quality transit service or service that is frequent and operates all day. We measure travel time to show the attractiveness of transit compared to automobile travel. Finally, we measure reliability to show whether residents can rely on transit as a viable transportation option.

RESULTS

Parking Demand

The results show that parking demand is lower than the amount supplied in both urban centers, suggesting that parking is overbuilt. Figure 2 displays the difference between parking demand and supply per study site and the weighted average. The samples sites were represented by identification codes because of confidentiality agreements. The weighted average parking demand in FHCH is 0.52 vehicles per dwelling unit, and the parking supply ratio is 0.74, showing a 0.21 vehicle per dwelling unit oversupply of parking. The weighted average parking demand in Redmond is 1.08 vehicles per dwelling unit, and the parking supply ratio is 1.66, showing a 0.57 vehicle per dwelling unit oversupply of parking.

The observed parking demand found in this study is less than the ITE *Parking Generation* recommended ratios in both urban centers. Observed demand in FHCH (0.52) is almost half of what ITE recommends, and in Redmond observed demand (1.08) is still less than the ITE recommendation, but only by 0.12 spaces per dwelling unit. This finding suggests a suburban bias in the data published in the *Parking Generation* report.

To investigate the demand and supply imbalance, it is important to understand the parking regulations under which each apartment building construction was permitted. Because parking regulations often change, we researched the legislative history of each urban center's zoning code to find the applicable parking requirement. Table 2 summarizes the year each apartment building was built and the parking requirement of the master use permit approval.

Alternative Parking Demand Methodology (DOL) Analysis

The DOL registered vehicle database counts ranged from 40 vehicles below the observed counts to 25 above, with an average difference of -4.88 for all sites. Although this analysis suffers from a small sample size and a large standard deviation, the DOL registered vehicle method has a strong association with the field observed method. Using regression analysis, the eight study sites were found to have 92 percent of the field observation counts explained by the DOL registered vehicle count ($r^2 = 0.92$). However, the large standard deviation shows that further investigation is necessary to determine whether the DOL data can be used as a proxy.

Transit Level of Service

The result of the transit level of service indicator analysis shows a clear difference in the type of transit service available to residents in each urban center (see Table 3). Transit service is more accessible and frequent in FHCH. Fifty-two percent of residents have access to frequent service compared to 30 percent in Redmond. Residents have similar walking access to all-day transit service in each urban center, but residents in FHCH benefit from 70 percent of all their transit service operating all day, compared to 46 percent in Redmond. Interestingly, Redmond shows that, on average, travel to major employment centers is a half-minute faster in transit when compared to the automobile and is two minutes slower via transit from FHCH to major employment centers. This finding is likely due to Redmond's geographic location at the end of a highway with intense congestion at peak hours. The transit service is able to use the high-occupancy vehicle (HOV) lanes and has an advantage over the automobile traffic. Transit travel times from FHCH to major employment centers generally take an average of eight minutes less compared to Redmond. Finally, transit service is generally more reliable in FHCH, with better on-time performance.

Table 3. Transit level of service indicator results.

Indicator	FHCH	Redmond
Geographic Frequency	52%	30%
Geographic Span	100%	100%
Travel Time	2	-0.5
Reliability	2.58	3.67

A HYPOTHESIS OF THIS STUDY IS THAT GREATER LEVELS OF TRANSIT SERVICE WILL YIELD A LOWER PARKING DEMAND FOR MULTIFAMILY RESIDENTIAL DEVELOPMENTS IN THE URBAN CENTERS.

LIMITATIONS

Some limitations exist in this study. First, the parking demand estimates are based on a small sample size because of limited time and resources. Also, the findings from the DOL analysis suffer from a small sample size and should be expanded to better understand the use of this alternative method. Second, this study only focuses on the relationship of transit level of service with residential parking demand. It is anticipated that other factors influence parking demand, such as mixed land use and alternative transportation facilities. Local government should allocate more resources to conduct more empirical research on parking and its relationship between land use and alternative transportation.

CONCLUSIONS

For decades the belief of residential parking practice was that generous supply of off-street parking spaces would help reduce traffic congestion and limit spillover of parking into surrounding neighborhoods. However, the requirements that many cities place on developers to build excess parking supply has proved to encourage automobile use, increase development costs, decrease housing affordability, consume more land and natural resources, increase air and water pollution, and prohibit smart growth. As planners better understand the relationships between parking, transportation choices, land use, and environmental impacts, it is important to evaluate how parking policies can be modified to achieve the optimal balance of off-street parking.

A hypothesis of this study is that greater levels of transit service will yield a lower parking demand for multifamily residential developments in the urban centers. As a result of the combination of mixed-use development, shorter distances to many destinations, higher jobs-to-housing balance, and more frequent and diverse transit services, people may have viable alternatives to owning or driving a car. Then, they will demand less residential parking spaces than isolated, single-use suburban environments. As presented earlier in this study, FHCH contains a higher level of transit service and a lower parking demand when compared to Redmond. FHCH has half the parking demand of Redmond and performs better on at least two of the transit level of service indicators.

Parking policies were reviewed in each urban center to assess their ability to meet the observed parking demand. In FHCH, all parking requirements have been removed, leaving the parking supply decisions entirely up to developers. This market-oriented policy is supported by many academics because it tends to result in a supply that is closer to the actual demand of the targeted tenants and can reduce the amount of parking oversupply.[6] The effect of having no parking requirement in FHCH is still to be determined, but it is anticipated that the parking supply will be close to the observed parking demand ratio, 0.5. In Redmond, the average parking supply rate is much larger

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than the minimum requirement, at 1.66. Redmond has an opportunity to adjust its parking requirement to meet demand by lowering either the parking minimum or maximum. In addition to reducing the minimum parking requirement ratio, both urban centers should implement additional reductions to the required parking in their zoning codes. For example, cities can offer reductions to required parking when developers build near frequent transit service, implement car-sharing programs, adopt transportation management programs, design for pedestrian and bicycle access, and share parking between land uses that have different peak period demands.

Parking policy has a key role to play in facilitating a shift away from auto-oriented communities to ones that are conducive to alternative transportation options, such as transit use. FHCH and Redmond provide an important example of the complexities involved with managing off-street parking supply. Since every community is unique, it is critical for planners and developers to have access to up-to-date information on parking demand. When planners and developers better understand parking demand and its relationship to transit level of service, they can make more informed decisions about shaping development that improves the quality of life and enhances the vitality of its communities. ■

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